Douglas Aircraft Co., Inc.

El Segundo Division

El Segundo, California, U.S.A.

PILOT'S HANDBOOK

FOR THE

MODEL 8A-5 AIRPLANE

SEE FLYING REVIEW INTERNATIONAL
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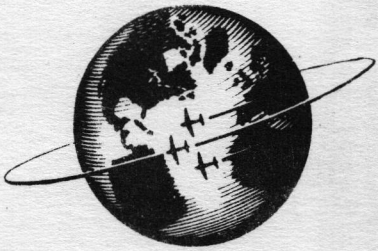

SALES ORDER 300

DETAIL SPECIFICATION 85-C

EL SEGUNDO DIVISION

DOUGLAS AIRCRAFT CO., INC.

EL SEGUNDO, CALIFORNIA, U. S. A.

SEPTEMBER 16, 1940

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P R E F A C E

The information contained herein is the result of factory and operators' service experience and constitutes the generally accepted practice of operation for this particular airplane.

These instructions are furnished for the operators' information and without any warranty incident thereto. Furthermore, the Douglas Aircraft Company reserves the right to make changes to this information at such time that advanced methods of operation may be forthcoming from the above sources.

DOUGLAS AIRCRAFT
COMPANY, INC.

8231 - Douglas Model 8A-5

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2. GENERAL CHARACTERISTICS

	ATTACK	BOMBER
Gross Weight	(3,535 kgs.) -7,795 lbs.	(3,900 kgs.) -8,600 lbs.
Fuel Capacity - Total (Reserve, Included in Total)	(352 liters) 93 gals.	(745 liters) 197 gals.
Wing Area	(33.7 M.^{2}) 363 Ft.^{2}	(33.7 M.^{2}) 363 Ft.^{2}
Wing Span	(14.43 M.) 47.7 Ft.	(14.43 M.) 47.7 Ft.
Engine Power:		
* Take Off & Military, 5 min. limit at 2500 r.p.m.	(1218 C.V.) 1200 H.P.	(1218 C.V.) 1200 H.P.
** Rated Power, maximum for Protracted Periods at 2300 r.p.m.	(1014 C.V.) 1000 H.P.	(1014 C.V.) 1000 H.P.
***Rated Altitude: Low Blower	(2073 M.) 6,800 Ft.	(2073 M.) 6,800 Ft.
High Blower	(4635 M.) 15,200 Ft.	(4635 M.) 15,200 Ft.
Wing Loading	(105 kgs/M.^{2}) 21.45 lbs/Ft.^{2}	(115 7 kgs/M.^{2}) 23.7 lbs/Ft.^{2}
Power Loading	(3.48 kgs/C.V.) 7.79 lbs/H.P.	(3 84 kgs/C.V.) 8.6 lbs/H.P.
High Speed at Sea Level (Military Rating)	(386 K.P.H.) 240 M.P.H.	(360 K.P.H.) 224 M.P.H.
High Speed: Military, at (4,785 meters) 15,700 feet	(425 K.P.H.) 264 M.P.H.	(397 K.P.H.) 247 M.P.H.
Normal, at (5,150 meters) 16,900 feet	(416 K.P.H.) 259 M.P.H.	(384 K.P.H.) 239 M.P.H.
Stalling Speed at Sea Level (Flaps Down)	(105.5 K.P.H.) 65.6 M.P.H.	(110.7 K.P.H.) 68.8 M.P.H.
Stalling Speed at Sea Level (Flaps Up)	(122 K.P.H.) 76 M.P.H.	(128 2 K.P.H.) 79.7 M.P.H.
Maximum Rate of Climb at Sea Level (Take-off Rating)	(680 M./Min.) 2,230 Ft/Min.	(565 M./Min.) 1,853 Ft/Min.
Service Ceiling	(9,210 M.) 30,200 Ft.	(8,380 M.) 27,500 Ft.
Take-Off Distance Over (15.25 Meter) Obstacle at 50 Feet Sea Level	(290 M.) 995 Ft.	(316 M.) 1035 Ft.
Cruising Speed at 65% Power at (3048 Meters) 10,000 Feet	(342 K.P.H.) 213 M.P.H.	(315 K.P.H.) 196 M.P.H.

	BHP	C.V.	BLOWER	RPM	ALTITUDE	MANIFOLD PRESSURE
*	1200	(1218)	Low	2500	S.L. to 4250 ft. (S.L. to 1296 M.)	45.5 to 43 in. (115.6 to 109.3 cm)
	1000	(1014)	High	2500	9,250 to 14,000 Ft. (2,820 to 4,270 M.)	46.5 to 44.5 in. (118.2 to 113 cm.)
**	1000	(1014)	Low	2300	S.L. to 7000 Ft. (S.L. to 2130 M.)	39.1 to 37.3 in. (99 to 92.2 cm.)
	900	(913)	High	2300	9,700 to 15,200 Ft. (2,955 to 4,640 M.)	41.8 to 40.3 in. (106.2 to 102.4 cm)

***Rated Altitude - Maximum Altitude where it is possible to develop rated power. Full throttle can be used at or above this altitude.

1. FOREWORD

This handbook contains the information necessary to acquaint the service pilot with all the controls, characteristics and equipment of the 8A-5 airplane and should be studied before each pilot's first flight.

The 8A-5 airplane is a two-place single engine, full cantilever low wing monoplane attack bomber. It is equipped with hydraulically operated wheel brakes, landing flaps and retractable landing gear.

The elevator, rudder and aileron controls are of the conventional type. The balance of the airplane is adjusted by movable control surface tabs.

All the information necessary for the proper operation of the airplane and its several characteristic features are given in this book.

The Alphebetical Index provides a quick cross reference to page numbers for any information desired which is given in this book.

The complete airplane is described in detail in Erection and Maintenance Manual also furnished with each airplane.

3. STRENGTH

The 8A-5 airplane is designed for attack maneuvers, and applied load factors are based upon a gross weight of 7500 lbs. (3400 kgs.) and a maximum applied indicated diving speed of 270 m.p.h. (435 k.p.h.). The term "applied" indicates a limit condition which is NOT to be exceeded in flight. Any deviation in gross weight or speed will change these permissible factors.

The applied flight maneuvering load factors which the structure can sustain without permanent deformation for a gross weight of 7500 lbs. (3400 kgs.) are:

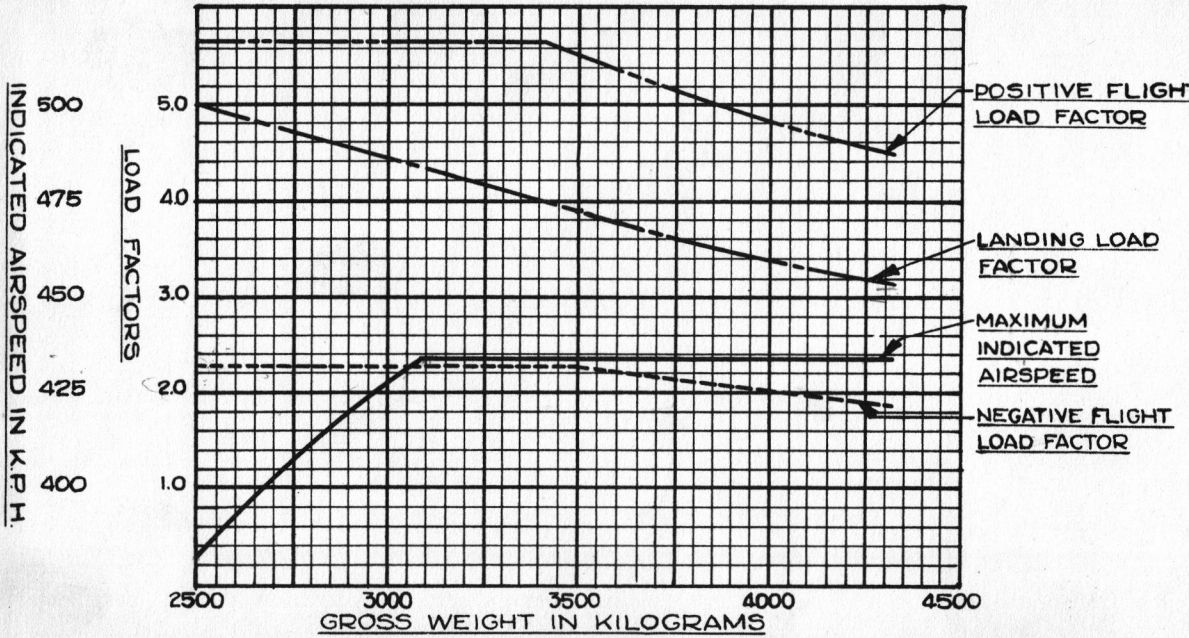
Positive	5.67
Negative	-2.33

These permissible load factors are reduced for greater gross weights as shown on page 5. Care should be taken in pull outs and maneuvers not to exceed these factors.

The applied flight gust load factors which the structure can sustain without permanent deformation for a gross weight of 7500 lbs. (3400 kgs.) are based upon the airplane striking a 30 ft./sec. (9.15 m/sec.) gust

at an indicated airspeed of 270 m.p.h. (435 k.p.h.). Higher airspeeds or lower gross weights increase the load factors obtained in the gusts. A curve of permissible indicated airspeed vs gross weight is given on page 5. Care should be taken to limit the maximum indicated airspeed to the allowable value.

The applied landing load factor is 4.0 based upon a gross weight of 7500 lbs. (3400 kgs.). Since the permissible load factor varies inversely with the gross weight, care should be taken when landing at a gross weight exceeding 7500 lbs. (3400 kgs.). The variation of the permissible load factor is shown on page 5.



PERMISSIBLE APPLIED LOAD FACTORS & SPEEDS vs GROSS WEIGHTS

4. FLIGHT OPERATION

The 8A-5 flies normally in every respect with wing landing flaps closed or open. The elevator control tabs provide longitudinal balance and the rudder control tabs provide directional trim for all permissible loading conditions. The elevator control tabs are quite sensitive. When a passenger is not carried in the rear cockpit, 200 lbs. (90 kgs.) of ballast secured in the rear seat is advisable to prevent the airplane becoming too nose heavy.

Lateral trim adjustment is accomplished by means of the aileron trim tabs to accommodate for right or left wing heaviness. These adjustments can only be made on the ground while the airplane is at rest.

Maneuvers

Loaded as an Attack, the airplane is capable of successfully performing the following maneuvers:

a. Loops
b. Immelmann Turns
c. Chandelles
d. Slow Rolls
e. Vertical Turns
f. Spins

When the airplane is loaded as a bomber, the flying should be restricted to slow maneuvers, not including acrobatics. The limited dive or glide velocity shall at no time under any loading conditions exceed 270 m.p.h. (434 k.p.h.).

Pre-starting Procedure

Make sure that the parking brakes are locked "ON" or that the wheels are blocked; that the landing gear selector valve lever is in the "DOWN" position; that the spreader bar is removed from between the wheels and the master battery switch is "ON".

Check the quantity of fuel in each tank and set the selector valve to the tank to be used.

Check the quantity of oil and see that all lines are open.

If the engine has not been running within the past hour, pull the propeller through by hand, at least four revolutions in direction of rotation to insure that the combustion chambers are clear of any liquid.

Set throttle slightly opened for 600 to 800 r.p.m.

Set fuel mixture control lever to the "FUEL CUT-OFF" position.

Set supercharger lever in "LOW" blower position.

Set propeller safety switch "ON" and selector switch to "AUTOMATIC". Set governor control for 2500 r.p.m.

Carburetor air control in "OFF" until engine has started. This is a precaution against fire in case of possible engine back-firing.

Starting

Operate the fuel hand pump slowly until .703 to 1.12 kgs/cm^2 fuel pressure is attained. A greater pressure may flood the carburetor and make starting difficult. Keep the handle forward when pump is not in use, to clear the bomb release unit.

Prime 5 or 6 strokes. If engine is warm no prime is necessary. KEEP THE PRIMER VALVE OFF EXCEPT DURING PRIMING OF ENGINE. The pressure pump is located on the right side of the pilot's cockpit below the engine instrument panel. Priming should be done while the inertia starter is being wound up, thus the raw fuel will remain in the cylinders the shortest possible time. If additional priming should

be necessary to keep the engine running, prime with the pressure pump, do not move the throttle.

Make sure there is no obstruction in the arc of the propeller.

Use the inertia starter at this point.

HAND -- Insert inertia starter crank in the crank extension right side accessory cowling, wind up to speed necessary to turn engine (for a period of thirty seconds or when winding has reached the pitch deemed necessary to pull the engine through).

Turn ignition switch to "BOTH" (located at bottom of electrical switch panel, left side of front cockpit).

Depress with heel the rear end of the starter pedal (right forward corner of pilot's floor) which energizes the meshing solenoid and booster coil, thereby turning over the engine.

ELECTRIC -- Turn ignition switch to "BOTH". Depress with toe the forward end of the starter pedal (right forward corner of pilot's floor), which starts the electric motor of the inertia starter.

Hold forward end of pedal depressed until the winding has reached the pitch deemed necessary to pull the engine through.

Depress with heel the rear end of the starter pedal which energizes the meshing solenoid and booster coil, thereby turning over the engine.

NOTE: The electric inertia starter pedal is wired to the ignition switch hence the necessity of turning the ignition switch on before starting the inertia motor. The starter pedal being inoperative when the ignition switch is off prevents accidental starting of the engine.

Continue to pump primer intermittently as required after the engine starts firing to keep it running. Do not move throttle. The primer must be "OFF" except when priming the engine.

CAUTION: Excessive priming has a tendency to wash the oil off the cylinder walls and cause scoring and seizing of the barrels and pistons. It also wets the spark plugs preventing their efficient functioning. Do not prime through the exhaust ports or the spark plug holes with raw fuel.

As soon as the engine starts to fire, move the mixture control to "AUTOMATIC RICH". If the engine does not start after 2 or 3 turns of the propeller, prime by moving the mixture control out of "FUEL CUT-OFF" for approximately 1/2 turn of the propeller and then back to "FUEL CUT-OFF". When the engine starts firing during this operation, move the mixture control to the "AUTOMATIC RICH" position.

When the engine fires smoothly, open throttle slowly to 1000 r.p.m. Check oil pressure. If pressure does not reach 2 to 3 kgs/cm^2 within 30 seconds stop the engine and investigate.

Warm-Up

A thorough warm-up is recommended. During the warm-up, leave the carburetor heat control in the same position as for starting. With the mixture control in the "AUTOMATIC RICH" position run the engine at 1000 r.p.m. until the oil pressure indicates 2.8 to 4.9 kgs/cm^2. Then continue the warm-up at 1100 r.p.m. until the oil temperature reaches 38°C., or in cold weather, until the oil temperature rise of 6°C. minimum is obtained. This is an indication that oil is circulating properly through the engine and oil lines.

Open the throttle to the recommended cruising manifold pressure, (66 cm. Hg. 1900 r.p.m.) long enough to check the magnetos and the fuel and oil pressures. If the oil pressure drops or fluctuates when the throttle is opened, continue the warm-up. All checks and ground running should be made with the propeller in "AUTOMATIC" and governor control set at 2500 r.p.m.

Do not exceed 76.2 cm. Hg. manifold pressure while making the magneto check. While checking magnetos listen and observe to the smooth running on each magneto rather than to minor and temporary r.p.m. drop. Return switch to "BOTH" after each check to permit the engine to clear out.

Check the two-speed supercharger for proper functioning in the following manner:

With the propeller in the high r.p.m. position, close the throttle completely, move the clutch control lever to the "HIGH" position and lock. Open the throttle to obtain not more than 76.2 cm. Hg. When the engine speed has stabilized, observe the manifold pressure and shift the supercharger control to the

"LOW" position without moving the throttle. A sudden decrease in manifold pressure is an indication that the two-speed supercharger drive is operating properly.

For full power test, engine should turn at 2500 r.p.m. (propeller in automatic), and 2550 r.p.m. (propeller in manual). Do not exceed 115.5 cm. Hg. manifold pressure for this test.

Prolonged full r.p.m. should not be conducted on the ground as the cylinder cooling is insufficient. Do not exceed 232°C. head temperature.

Before taking off be sure the heads have cooled sufficiently to allow a normal take-off and climb, and not exceed temperature limits.

Take-Off

Secure ballast of 200 lbs. (90 kgs.) to rear seat if passenger is not carried.

Rudder tab set at approximately 3° right and elevator tabs set at neutral. After thorough familiarization, the pilot may prefer a slight deviation from these settings. The tabs are sensitive in action.

Make sure the bomber's compartment is fully retracted.

Mixture Control in "AUTOMATIC RICH".

Propeller governor control set for 2500 r.p.m. and switch on "AUTOMATIC".

Supercharger control lever in "LOW" blower.

Observe cylinder head temperature indicator and do not take-off unless head temperature is less than 120°C.

Carburetor air intake "OFF". If atmospheric icing conditions are prevalent then set air intake control to "ON". Never use intermediate positions.

Open throttle slowly to 115.5 cm. Hg.

Maximum cylinder head temperature during take-off 232°C.

Use of Propeller Governor Control

When using a controllable propeller, the governor should be set to the r.p.m. and the throttle set to the manifold pressure.

When increasing the power, the governor should first be set to the desired speed and the throttle adjusted to obtain desired manifold pressure.

When decreasing the power, set the manifold pressure first with the throttle control and then adjust the r.p.m. with the propeller governor control.

MILITARY POWER CLIMB

(5 minute duration only)

With all controls except the throttle set as for take-off, set manifold pressure and operate engine in accordance with Table 1.

Never exceed manifold pressures as given in Table 1.

After 5 minutes of military climb in routine operation have elapsed, reduce speed to 2300 r.p.m. and climb at normal rated power in accordance with Table 2. Military climb may be resumed after 10 minutes at normal rated power.

Leave the mixture control in "AUTOMATIC RICH". Above 3048 meters if the engine is rough due to rich mixture, it is permissible

to lean out mixture manually to maintain smooth engine operation.

Do not exceed a cylinder head temperature of 232°C.

TABLE 1

Military Power at 1200 HP at 2500 r.p.m. (5 minutes only)

Pressure Altitude	Manifold Pressure	Blower Ratio
Sea Level	115.5 cm.	Low
610 M.	112.5 cm.	Low
1220 M.	109.7 cm.	Low
1830 M.	Full throttle	Low
2438 M.	Full throttle	Low
3048 M.	113.0 cm.	High
3658 M.	113.0 cm.	High
4267 M.	Full throttle	High

NORMAL RATED POWER CLIMB

Set mixture control in "AUTOMATIC RICH".

Set propeller governor for 2300 r.p.m. in "AUTOMATIC".

Set manifold pressure according to Table 2.

Do not exceed a cylinder head temperature of 218°C.

TABLE 2

Pressure Altitude	Manifold Pressure	Blower Ratio
Sea Level	99.3 cm.	Low
610 M.	97.7 cm.	Low
1220 M.	96.5 cm.	Low
1830 M.	94.9 cm.	Low
2438 M.	Full throttle	Low
3048 M.	105.9 cm.	High
3658 M.	104.1 cm.	High
4267 M.	102.8 cm.	High
4632 M. and over	Full throttle	High

CRUISING POWER CLIMB

Set mixture control in "AUTOMATIC RICH".

Set propeller governor for 2000 r.p.m. in "AUTOMATIC".

Set manifold pressure and fly according to Table 3.

Do not exceed a cylinder head temperature of 218°C.

TABLE 3

Pressure Altitude	Maximum Cruise (2000 r.p.m.) Manifold Pressure	Maximum Cruise (2000 r.p.m.) Blower Ratio	Recommended Cruise (1900 r.p.m.) Manifold Pressure	Recommended Cruise (1900 r.p.m.) Blower Ratio
610 M.	73.9 cm.	Low	69.3 cm.	Low
1220 M.	72.3 cm.	Low	67.8 cm.	Low
1830 M.	71.1 cm.	Low	66.5 cm.	Low
2438 M.	69.8 cm.	Low	65.0 cm.	Low
3048 M.	68.5 cm.	Low	63.5 cm.	Low
3658 M.	67.0 cm.	Low	62.4 cm.	Low
4267 M.	Full throttle	Low	61.2 cm.	Low
4876 M.	78.2 cm.	High	71.6 cm.	High
5486 M.	76.7 cm.	High	70.3 cm.	High
5791 M.	Full throttle	High	69.5 cm.	High
6096 M.	Use full throttle	High	69.0 cm.	High
6172 M.	Use full throttle	High	Full throttle	High

HIGH SPEED LEVEL FLIGHT

Military Power (5 minute duration)

Set mixture control in "AUTOMATIC RICH".

Set propeller governor control for 2500 r.p.m. in "AUTOMATIC".

For absolute maximum high speed, fly at the full throttle altitude for the following manifold pressures:

In low blower - - 109.2 cm.
In high blower - 113.0 cm.

For high speed at military power at any other altitude, maintain the manifold pressure specified in Table 1, for that altitude.

Throttle the engine back to normal rated power or less after each 5 minutes of military power operation in either climb or level flight and hold there for a minimum of 10 minutes before resuming military power running.

HIGH SPEED LEVEL FLIGHT

Normal Power Rating

Set mixture control in "AUTOMATIC RICH".

Set propeller governor control for 2300 r.p.m. in "AUTOMATIC".

For maximum high speed at normal rated power fly at the full throttle altitude for the following manifold pressures:

In low blower - - 94.7 cm.
In high blower - 102.3 cm.

For high speed at normal rated power at any other altitude, maintain the manifold pressure specified in Table 2, for that altitude.

Do not exceed a cylinder head temperature of 218°C.

LEVEL FLIGHT - Cruising Power

Set mixture control in "AUTOMATIC LEAN".

Set propeller governor control for 2000 r.p.m. in "AUTOMATIC" for maximum cruising, or 1900 r.p.m. in "AUTOMATIC" for recommended cruising power.

For maximum speed at cruising power, fly at the full throttle altitude for the following manifold pressures:

In low blower - - 72.0 cm.
In high blower - 76.2 cm.

For maximum speed at maximum or recommended cruising power at any other altitude, maintain the manifold pressure specified in Table 3.

Landing

Set mixture control in "AUTOMATIC RICH".

Set supercharger control in "LOW" position.

Set carburetor air intake control in the "OFF" position, except under icing conditions, for which set to "ON" position.

Set propeller governor control to high r.p.m. stop in "AUTOMATIC".

Bomber's compartment fully retracted.

Landing gear fully extended and locked.

Landing flaps fully extended. Do not extend flaps at a speed greater than 110 m.p.h. (176 k.p.h.).

Landing flares, if necessary, should not be released at a speed greater than 150 m.p.h. (210 k.p.h.).

Check quantity of fuel in tank in use. If gage shows near empty,

switch to tank containing most fuel.

It is recommended that landing flaps be used during all landing operations, however, landing resulting in an increased landing speed may be accomplished without their use.

The airplane settles rapidly with the landing flaps extended, so approaches should be made with ample power.

Due to the braking effect of the flaps the airplane comes to rest rapidly without undue use of the brakes.

Taxiing

The airplane can be controlled satisfactorily on the ground by the use of the landing wheel brakes.

Landing flaps should be closed immediately after completion of the roll so that they will not be damaged by dirt, stones, etc. thrown into the flaps by action of the propeller slipstream.

The tail is steerable with the rudder for 30° each side of neutral. Beyond this limit the steering mechanism is automatically released and

the wheel is free to swivel throughout the remaining 300°. In making short turns while taxiing, use the extreme rudder movement in order to release the tail wheel.

Stopping the Engine

With all controls set as in landing, idle the engine at 600 to 800 r.p.m. until cylinder head temperatures fall below 148°C.

Increase engine r.p.m. to 1000, hold for 1/2 minute to obtain optimum scavenging of oil from the engine before shutting down. Then move mixture control to the "FUEL CUT-OFF" position. After mixture control has been placed in the "FUEL CUT-OFF" position do not open or "pump" the throttle as this will force a charge of raw fuel into the cylinders. The engine will stop in a few seconds. Turn ignition switch off after engine stops turning.

Turn off fuel tank selector valves.

Leave the mixture control lever in the "FUEL CUT-OFF" position as a precaution against accidental starting.

WRIGHT ENGINE OPERATION CHART - ENGINE MODEL GR-1820-205A

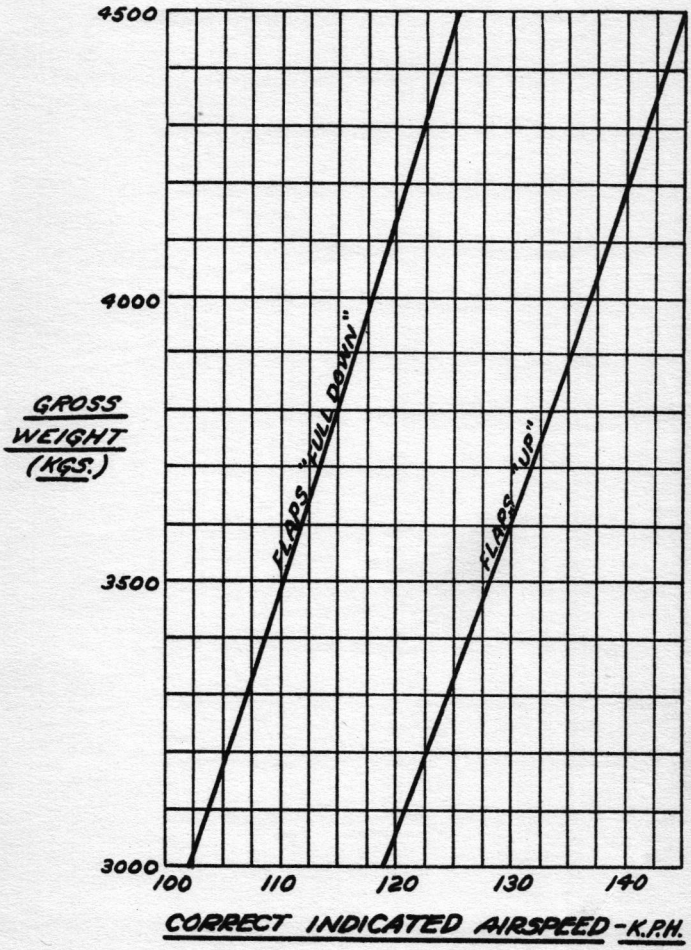
OPERATING CONDITION	ALTITUDE METERS	R.P.M. (Set by propeller governor)	MANIFOLD PRESSURE cm. Hg.	MIXTURE CONTROL	BLOWER RATIO	MAXIMUM CYLINDER HEAD TEMPERATURE	OIL INLET TEMPERATURE °C.		OIL PRESSURE KGS/CM²	FUEL PRESSURE KGS/CM²
							Desired	Maximum		
Pre-flight	- -	- -	- -	Cut-off	Low	- -	- -	- -	- -	- -
Starting	- -	600-800	- -	Cut-off	Low	- -	38	- -	2.10-4.56	.70 - 1.12
Warm-up	- -	1000-1200	76.2	Auto-Rich	Low	238	55	74	2.81-4.56	.98 - 1.12
Take-off	Sea Level	2500	115.5	Auto-Rich	Low	238	74	88	4.56-5.27	.98 - 1.12
Military Power Climb	SL - 1311 3048-4267	2500	115.5-109.2 113.0	Auto-Rich	Low High	238	74	88	4.56-5.27	.98 - 1.12
Normal Rated Power Climb	SL - 2134 2927-4632	2300	99.3- 94.7 106.1-102.3	Auto-Rich	Low High	218	74	88	4.56-5.27	.98 - 1.12
Cruising Power Climb Maximum	SL - 4267 4267-5791	2000	75.6- 66.0 79.2- 76.2	Auto-Rich	Low High	218	74	88	4.56-5.27	.98 - 1.12
Cruising Power Climb Recommended	SL - 4673 4673-6172	1900	70.6- 60.4 71.8- 69.3	Auto-Rich	Low High	218	74	88	4.56-5.27	.98 - 1.12
Military Power, Level Flight	SL - 1311 3048-4267	2500	115.5-109.2 113.0	Auto-Rich	Low High	238	74	88	4.56-5.27	.98 - 1.12
Normal Rated Power, Level Flight	SL - 2134 2957-4672	2300	99.3- 94.7 106.1-102.3	Auto-Rich	Low High	218	74	88	4.56-5.27	.98 - 1.12
Cruising Power, Level Flight - Maximum	SL - 4267 4267-4876	2000	75.6- 66.0 79.2- 76.2	Auto-Lean	Low High	204	74	88	4.56-5.27	.98 - 1.12
Cruising Power, Level Flight - Recommended	SL - 4693 4693-6172	1900	70.6- 60.4 71.8- 69.3	Auto-Lean	Low High	204	74	88	4.56-5.27	.98 - 1.12
Landing	- -	2500	- -	Auto-Rich	Low	204	74	88	4.56-5.27	.98 - 1.12
Stopping	- -	- -	- -	Cut-off	Low	148	- -	- -	- -	- -

LANDING SPEED CHART

(See Page 26)

The landing speed chart gives indicated airspeed with "flaps up" and "flaps down" as a function of airplane gross weight.

These curves are independent of temperature or altitude, and they are to be interpreted as safe indicated landing speeds rather than minimum indicated landing speeds.



LANDING SPEED CHART 8A-5

(5% ABOVE STALLING SPEED)

5. POWER PLANT

The engine is a Wright Model GR1820-G205A air cooled radial engine, geared drive in the ratio of 3:2. It is designed to operate on 90 octane fuel.

Maximum Diving Speed - Never exceed 2760 r.p.m.

Fuel - W.A.C. Specification 5804 (90 octane). Required pressure at carburetor inlet .984 --1.124 kgs/cm^2.

Oil - W.A.C. Specification 5817.
Required pressure 4.56 to 5.27 kgs/cm^2.
Desired oil inlet temp. 74° C.
Maximum oil inlet temp. 88° C.
For emergency only 104° C.

Cylinder Head Temperatures - Never exceed these limits.

Ground Operation	232°C.
Military Power Climb and Level Flight	232°C.
Normal Rated Power Climb & Rated Flight	218°C.
Cruising Power Climb	218°C.
Cruising Power Level Flight	205°C.
Minimum for Take-Off	150°C.

Horsepower Rating	BHP	RPM	Pressure Altitude Meters	Manifold Pressure cm. Hg.
Take -off (low blower)	1200	2500	Sea Level	115.5
Military (low blower)	1200	2500	S.L.-1295	115.5-109.2
Military (high blower)	1030	2500	2820-4267	113.0
Normal (low blower)	1000	2300	S.L.-2130	99.3- 94.7
Normal (high blower)	900	2300	2957-4633	106.6-102.3
Maximum Cruising (either blower)	650	2000	S.L.-5800	
Recommended Cruising (either blower)	575	1900	S.L.-6175	

Manifold Pressure

The CONTINUOUS OPERATION CHART on page 65, gives the values of manifold pressure required to develop a given percentage of rated engine power at the altitudes indicated and at the particular values of r.p.m. for which this chart has been made.

The CRUISING CHARTS on pages 66 and 67, show the true airspeed vs. altitude for various powers. The lines of constant r.p.m. indicate the minimum value of r.p.m. required to obtain a given percentage of rated power at the indicated altitudes. The AIRSPEED CORRECTION CHART is shown on page 68.

When increasing the engine power, first increase the r.p.m. setting to a value corresponding to the desired manifold pressure, i.e., should the pilot desire to change from cruising power to rated power, he should change the propeller governor control from 1900 to 2300 r.p.m. before increasing the manifold pressure. When reducing power, such as after take-off, reduce the manifold pressure before reducing r.p.m.

Mixture Control

The mixture control on the Stromberg

PD12H3 carburetor has four definite positions: Full rich, automatic rich, automatic lean, and fuel cut-off.

The fuel mixture control lever, marked "B", is one of the three levers on the engine control quadrant, left side of pilot's cockpit.

The "FULL RICH" position is when the lever is full forward. The "AUTOMATIC RICH" position is approximately 10° aft of the "FULL RICH" position and is felt by a distinctive "click", which is carried through from the control rod forward of the firewall. The "AUTOMATIC LEAN" position is approximately 10° aft of the "AUTOMATIC RICH" position and is felt by a distinctive "click", which is carried through from the control rod forward of the firewall. The "FUEL CUT-OFF" position is full aft. The "FUEL CUT-OFF" position is painted red.

The "FULL RICH" position is only used in emergencies. In the event the automatic mixture compensating device in the carburetor fails, which would be evidenced by lack of load or altitude compensation, the mixture control should be advanced to "FULL RICH". This makes the

functioning of the carburetor similar to that obtained on a non-automatic carburetor.

Fuel will flow with the mixture control in any position except "FUEL CUT-OFF" whenever the fuel pressure is greater than .350 kgs/cm^2 even if the engine is not running. Therefore, the mixture control should be left in "FUEL CUT-OFF" whenever the engine is not turning over, to prevent fuel from collecting in the diffuser section and running out the drain tube.

The mixture may be controlled manually between the limits of automatic rich and automatic lean. To adjust between these limits, set the throttle to the desired manifold pressure and lean the mixture until the pointer on the Aero Mixture Indicator indexes with the manifold pressure on the indicator dial, which corresponds with the engine manifold pressure. At no time when the mixture control is set in the automatic lean position should the Aero Mixture Indicator be permitted to drop below .075.

The following values indicate recommended fuel/air ratios as shown by the Aero Mixture Indicator.

For Take-Off	.106 to .112
For Developing Rated Power	.103 to .106
For Cruising	.080 to .075

When adjusting the mixture control allow about 30 seconds for the indicator needle to become stabilized.

Aero Mixture Indicator

The Cambridge Aero Mixture Indicator has proven to be an accurate and reliable check on the operation of the mixture control provided the instrument is properly serviced and maintained. The actual mixture delivered to the engine is affected by factors independent of the position of the mixture control lever, as changes in altitude, air temperature, throttle position, fuel pressure, indicated airspeed and the consequent changes of ram.

In order to secure a stabilized needle position, each of the above must be stabilized. After repetition of its use, a satisfactory approximation will be obtained in the handling of the mixture control.

After a change in mixture, the instrument will not react immediately. Upon effecting a change in the mixture, the needle will move in a few seconds, but approximately 30

seconds is required to permanently register the change. For this reason the mixture must be leaned with great care.

When the needle appears to fluctuate erratically or gradually move from the lean to rich under apparently stabilized conditions, detonation is definitely indicated. When these signs appear the mixture should be immediately richened in order to avoid damage to the engine; then adjust the mixture control lever in a richer position than before. The increase of the temperature of the cylinder heads and irregular functioning of the engine accompanied by puffs of black smoke from the exhaust are signs of knocking or detonation.

When carburetor heat is applied, the mixture indicator will definitely go rich. This is caused by a diminishing of the quantity of air entering to the carburetor which naturally results in an excessively rich mixture. This condition will be remedied by leaning the mixture. Likewise and for the same reasons, when the carburetor heat is shut off, the mixture needle will show lean until possible detonation occurs. Consequently the mixture must be richened before closing off the hot air intake.

An apparently lean mixture indicated during descents with very low throttle and rich mixture control setting is caused by a combination of high ram and low fuel flow and is not necessarily an indication of dangerous engine operating conditions.

The Aero Mixture Indicator is wired to the ignition switch, hence it will begin to operate as soon as the ignition switch is turned on and inversely ceases to operate when the ignition switch is turned off.

Supercharger

The engine is equipped with a two-speed supercharger. Normally the low blower shall be used at all times. The high blower may be used above 3048 meters altitude to obtain maximum speeds and rates of climb. The high blower shall not be used at altitudes at which cruising power is available in low blower ratio as the fuel economy is inferior to that obtainable in low blower and the tendency to detonate is greater.

When shifting from "LOW" to "HIGH" blower, operate the two-speed blower control in the following manner, carefully observing the proper sequence:

Set mixture control "AUTOMATIC RICH".
Close the throttle completely.
Quickly move the supercharger clutch to the "HIGH" position and lock.
Re-open the throttle and set the desired manifold pressure.
Readjust the r.p.m. setting only as necessary to obtain desired power.

When shifting from "HIGH" to "LOW" blower, operate the two-speed blower control in the following manner:

Quickly move the supercharger clutch to the "LOW" position and lock.
Set the desired manifold pressure with the throttle.
Readjust the r.p.m. setting as necessary to obtain the desired power.

If flight conditions do not permit the two previous methods of shifting the clutch, the alternate method following may be used.

To change from "LOW" to "HIGH" blower:

Set the mixture control in "AUTOMATIC RICH".
Partially close throttle. (The

amount of closing will be determined by experience to give desired manifold pressure after the shift has been made).
Move the supercharger clutch rapidly from the "LOW" to "HIGH" position.
Readjust throttle setting if manifold pressure is not at the desired value for high blower operation.
Readjust the r.p.m. setting as necessary to obtain desired power.

To change from "HIGH" to "LOW" blower:

Move the supercharger clutch rapidly from "HIGH" to "LOW" position.
Readjust the throttle setting if manifold pressure is not at the recommended value for low blower operation.
Readjust the r.p.m. setting only as necessary to obtain desired power.

Changes from one gear ratio to the other in either direction should be made quickly without pausing in neutral to avoid rough operation during the clutch engagement period. During a change in gear ratio, a slight change in engine speed may be observed. This is normal for a two-speed engine and has no detrimental effects.

Care should be exercised at all times to make sure that the supercharger clutch is at the extreme end of its travel to prevent clutch slippage and to insure that rated power is always available.

Blower ratio changes should not be made at intervals of less than 5 minutes in order to provide opportunity for dissipation of heat generated during clutch engagement.

Carburetor Air Intake Control

The locking lever of the carburetor air intake control is located on the control pedestal, which is between the front rudder pedals. This control operates a valve which permits air to enter the carburetor through the air scoop on the leading edge of the anti-drag ring cowling, or through a passage inside the engine cowling. In case the air scoop becomes clogged by a formation of snow or ice, the lever should be moved from "OFF" to "ON". The engine is equipped with a Stromberg PD12H3 "non-icing" carburetor. Ice will not form in this carburetor due to vaporization of the fuel. Atmospheric ice (such as forms on the wing surfaces of airplanes) may form on the vents, booster venturis, throttles and the carburetor screen.

When flying in heavy rain with outside temperatures of from -1°C. to 21°C., keep the carburetor air intake control in the "ON" position. NEVER USE PARTIAL HEAT. The use of partial heat is not recommended since with the scoop valve in intermediate positions severe turbulence is introduced in the carburetor air stream and thus upsets the correct metering of the carburetor. When the air intake control lever is in the "ON" position always have the mixture control in the "AUTOMATIC RICH" position.

Propeller

The propeller is a Curtiss three blade, multi-position and/or constant speed type. It is operated electrically from the airplane electrical supply through brushes mounted in a housing, attached on the engine nose section to slip rings mounted on the rear boss of the propeller hub, thence to the pitch changing motor.

Automatic electric cut-out switches limit the pitch range for ordinary operation, and give high and low pitch settings.

Two types of control, manual selective and automatic, are available for selection by the pilot, the change from one to another being made by a toggle switch on the propeller control panel.

When on automatic control, a selected engine speed is held constant by an engine driven governor. Speed selection is accomplished by adjustment of the propeller governor control.

When on manual selective control, the propeller acts as a controllable pitch propeller, the blade angle of which may be varied by operation of the "INCREASE RPM" or "DECREASE RPM" switch. Circuits are independent of the governor so that if the governor fails the propeller can be used as a multi-position controllable propeller.

Since there are no markings on the propeller governor control except high and low r.p.m., the tachometer reading should be relied upon to obtain the desired r.p.m.

The propeller governor control is installed on the left side of the pilot's cockpit near the throttle quadrant. To operate: Turn the knob in the direction desired until the tachometer indicates the

selected r.p.m.

The knob is friction controlled which prevents creepage of the r.p.m. setting. The degree of friction may be easily altered on the ground.

Operation

Set safety switch, which is of the circuit breaker type, to "ON" position at all times propeller control is desired. If the switch throws out, it may be reset by turning it to "OFF", then to "ON". Successive throwing out will probably be an indication of a short circuit or overload and the switch should be left off. In the event this should occur, the pitch should be changed only if absolutely necessary.

Setting of Propeller and Governor Stops

The high r.p.m. propeller stop should be set so that the engine will turn 2550 r.p.m. with 115.5 cm. Hg. with propeller control switch in manual, when the airplane is stationary.

The high r.p.m. or take-off, governor stop should be adjusted to permit 2500 r.p.m. with 115.5 cm. Hg.

Operating instructions for various flight conditions are given under those flight conditions outlined in Part 4, "Flight Operations". A propeller check-off list for convenient use of pilot will be found on the following page.

PROPELLER CHECK-OFF LIST

CURTISS ELECTRIC PROPELLER

SAFETY SWITCH - "ON" at all times when operating airplane.

TAKE-OFF - Selector switch to "AUTOMATIC". Governor control set for take-off r.p.m.

CRUISING - Select desired r.p.m. with governor control. Adjust manifold pressure with throttle.

MANUAL SELECTIVE CONTROL - Selector switch to "MANUAL". Select desired r.p.m. with "INCREASE - DECREASE R.P.M." switch.

LANDING - Selector switch to "AUTOMATIC". Governor control to high r.p.m. stop.

RESET SAFETY SWITCH - When switch opens due to overload - Move to full "OFF" then to full "ON".

Fuel System

The total fuel capacity is 252 gallons (~~[illegible]~~ liters). Three fuel tanks are installed in each side of the wing center section. These tanks are not interconnected, therefore, a tank selector valve must be used to draw fuel from any one tank. The left front tank, 54.5 gallons (206.3 liters) capacity, carries the reserve fuel.

The fuel is normally delivered to the carburetor by an engine driven fuel pump. For starting and emergency operation a hand operated wobble pump may be operated from the pilot's cockpit. The desired fuel pressure is .98 to 1.12 kgs/cm^2.

The fuel quantity gage is electrically operated. To ascertain the amount of fuel in any tank, set the selector switch to the desired tank and read the gage.

Oil System

The oil tank has a filling capacity of 26 gallons (101 liters), leaving an expansion space of 3.3 gallons (12.5 liters). The oil temperature control, entirely automatic, is regulated by an oil cooler suspended below the lower engine mount

tubes. A combined thermostatic regulator and by-pass valve is attached to the oil cooler. The pressure and temperature at which the valve operates is permanently set and requires no attention.

The oil temperature gage is connected to the engine inlet oil line.

Normal Oil Temperature ... 74°C.
Normal Oil Pressure..4.56 - 5.27 kgs/cm^2.

NORMAL INSTRUMENT READINGS

The following table shows the instrument readings as taken during actual flight as a bomber with eight 100 lb. bombs.

INSTRUMENTS	CLIMBING Rated Power			CRUISING 65% Power		MAXIMUM SPEED Level Flight-Rated Power		
	Sea Level	2133 Meters	4633 Meters	Sea Level	3048 Meters	Sea Level	2133 Meters	4633 Meters
Manifold Pres.	99.3	94.7	102.4	75.7	68.6	99.3	94.7	102.4 cm.Hg.
Tachometer	2300	2300	2300	2000	2000	2300	2300	2300 r.p.m.
Fuel Pressure	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05 kg/cm^2
Oil Pressure	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9 kg/cm^2
Oil in Temp.	77	77	77	77	77	77	77	77°C.
Cyl. Head Temp.	218	218	218	205	205	218	218	218°C.
Airspeed	201	201	201	272	158	321	308	276 k.p.h.

6. FLIGHT CONTROLS

Rudder

The rudder is operated by pedals in the conventional manner. Attached to the inboard edge of each pedal is an adjustment, operated by the pilot's foot, by means of which the rudder pedals may be adjusted and locked in the position most comfortable for the pilot.

Control Stick

The elevators and ailerons are operated by a control stick in the conventional manner.

Built into the upper end of the control stick is a finger operated trigger which is connected through electric wires to the trigger solenoids of the .30 and .50 caliber fixed guns. The pilot can fire the guns without removing his hand from the stick.

In the top of the control stick is a thumb operated switch button to be used for the electrical selective release of external bombs.

Elevator Tabs

The elevators are fitted with trailing edge tabs for adjusting the

longitudinal balance of the airplane. The tab mechanism is operated from a suitably marked control box located on the left side of the pilot's cockpit.

Rudder Tab

The rudder is fitted with a trailing edge tab for adjusting the directional trim of the airplane. The tab mechanism is operated from the same box which controls the elevator tabs.

Aileron Tabs

A metal balance tab is built in the trailing edge of each aileron. These tabs are adjustable only on the ground, when the airplane is at rest.

Landing Flaps

Hydraulically operated split trailing edge flaps are fitted to both the outer wings and to the center section. They have an angular movement of approximately 45° down. A neutral position is provided in order that the flaps may be kept at any angle desired. Do not attempt to open the flaps at a speed in excess of 110 m.p.h. (175 k.p.h.).

To lower the flaps, move the flap valve handle located on the left side of the pilot's cockpit, to the "DOWN" position and push forward on the thrust rod knob, located at the left of the center instrument panel.

Hold the knob forward from two to five seconds. When the flaps are lowered the thrust rod knob will automatically return to its aft position.

To raise the flaps move the flap valve handle to the "UP" position and push forward on the thrust rod knob, hold the knob forward from two to five seconds. When the flaps are raised the thrust rod knob will automatically return to its aft position.

It is recommended that all operations of landing flaps be accomplished by means of the hydraulic hand pump. The desired angle of position of the flaps is more readily obtained than by use of the engine pump and pressure on the system will thereby only be about 200 lbs/sq.in. (14 kgs/cm^2). Before using the hand pump, make sure that the thrust rod knob is in its complete aft position.

NOTE: In case of an emergency when the flaps are in the "DOWN" position and it is desirable to flatten (or lengthen) the glide quickly, simply place the selector valve handle in the "UP" position allowing the force of the airstream to close the flaps. They will close to approximately 15°.

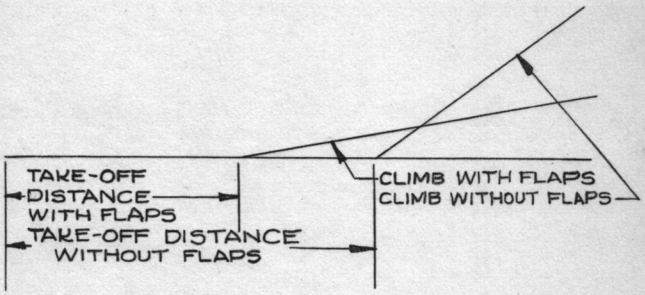
CAUTION: Since the stalling speed with flaps up is 18 k.p.h. (11 m.p.h.) higher than with flaps down, be sure that the airspeed is sufficient to compensate for the change in conditions before closing the flaps.

To raise or lower the flaps with the engine pump inoperative, move the flap selector valve lever to the desired position and operate the hand pump. Make sure the thrust rod knob is completely back.

Use of Flaps in Take-Off

The use of flaps in take-off is dependent upon several variables: the gross weight of the airplane; length of runway, and whether or not there are obstructions at the end of the runway. With the flaps lowered, the take-off run is shortened, but the initial rate of climb

is less than without flaps. The problem of flap use at take-off becomes extremely important in field operation where there is an obstacle to clear at the end of a relatively short runway. To compensate for the short runway, flaps would ordinarily be used, however, the use of flaps will handicap the effective climb. The problem, therefore, is to use only enough flap to clear both the end of the runway and the obstacle. The diagram below gives a relative comparison:



Surface Control Lock

A pair of locks is provided for holding the flight control surfaces in neutral when the airplane is parked. It consists of two separate tubes, each with a hole in the forward end, a hole in the middle

and a spring loaded pin in the rear end.

To set the locks, place the hole in the forward end of each tube over the nut on the bolt through the end of the rudder control cable, the hole in the middle over the pin in the side of the control pedestal, and pin the rear to the lug near the base of the control stick.

When not in use, the lock is stowed on the front of frame #4-1/2, behind the pilot's seat.

7. AUXILIARY CONTROLS

Landing Gear

The landing gear is a full cantilever single oleo pneumatic strut type. Rotation of the torque shafts retract the gear by swinging the wheels and struts inboard and up into the center section of the wings. The torque shafts are rotated by individual hydraulic operated cylinders connected to arms on the shafts, the pressure for which is furnished by an engine driven pump, or by an auxiliary hand pump at the right side of the pilot's seat.

A horn warning device, located in the left front corner of the pilot's cockpit, operates when the throttle is closed and the landing gear is in any position except fully extended and locked. The horn may be made inoperative by pushing the small handle on the warning switch box at the left side of the pilot's cockpit. The horn circuit automatically engages when the throttle is again closed.

To retract the wheels, push back the spring loaded lock which holds the latch control in the down position, and pull up the lever.

Push forward on the thrust rod knob, located just to the left of the center instrument panel. Hold the knob forward from two to five seconds then release.

When the wheels are fully up, the forward luminous mechanical indicator arms will protrude through the upper skin of the center section over the wheels. The indicators, easily visible from the cockpit, are a positive indication that the wheels are fully retracted.

To extend the wheels, push down the lever, push forward on the thrust rod knob. Hold the knob forward from two to five seconds. When both wheels are locked in the extended position, the rearward luminous mechanical indicator arms will protrude through the upper skin of the mechanism lock. The indicators, easily visible from both cockpits, are a positive indication that the wheels are fully extended and locked. Also, when both wheels are locked in the extended position and the engine is idling, the warning horn will cease to operate.

NOTE: Do not continue to hold the thrust rod in the forward position. When the operation is complete, the knob will

automatically return to its aft position.

Brake System and Parking Brake

The brakes are operated by individual master cylinders which are connected by a linkage to the brake pedals.

To lock the parking brakes, press both brake pedals and pull the brake lock handle located on the control pedestal in front of the pilot, then release the pedals.

NOTE: In case the brakes have been set and locked with sufficient force to completely compress the compensator springs, and an abnormal rise in temperature should then occur, the fluid may expand enough to set the brakes to such an extent that they cannot be released by foot pressure on the pedals. If this condition should occur, the pressure in the system may be relieved by allowing several drops of fluid to escape from the bleeder valve to each brake.

8. EQUIPMENT

Cockpit Ventilator

The cockpit is ventilated by means of an air inlet located in the floor just aft of the control pedestal. The inlet opening is regulated by a flap valve which is opened or closed by the pilot's foot.

Cockpit Heater

The cockpit heater control is located on the control pedestal in front of the pilot.

Enclosure Locking Arrangement

The pilot's cockpit enclosure can be moved aft over the over-turning structure and latched open in any of five positions. The latch handle is located inside the lower left front end of the enclosure.

A small lever connected to the inside latch projects through the enclosure permitting the section to be unlatched from the outside.

The laminated glass side panels of the pilot's cockpit enclosure are hinged at the top and fastened by

a pin at the bottom. Removal of the pin by pulling an easily identified ring affords an opening for an emergency exit.

Life Preserver Cushion

A life preserver cushion, for use in emergency landings on water, is attached to the back of the pilot's seat by means of two hooks. To use: Remove the cushion from the hooks and lift vertically. The cushion is not attached to the parachute harness, therefore, must be carried under the pilot's arm until the pilot is in the water at which time he must adjust the position of the cushion to fit circumstances.

Map Case

The map case is located forward of the pilot's seat and above the control pedestal. At delivery, the map case in each airplane contains one each: Master Wiring Diagram; Fuel Diagram; Oil Diagram and Pilot's Check-off List.

Oxygen Equipment

Oxygen mask, bag, regulator, flow gage and manifold pressure gage

are located on right side of cockpit.

Operation and flow is accomplished by turning the regulator in a clockwise direction, which opens the valve permitting the oxygen to flow to the mask.

The straight stem insert, at the end of mask tubing, is inserted in the plug-in valve, mask adjusted to face and regulator turned on.

Fire Extinguisher

A "Lux" CO_2 Fire Extinguisher System is installed under the engine accessory cowling designed to spray CO_2 gas around the carburetor in case of fire in the engine or accessory sections and is operated manually from the pilot's cockpit.

To operate, pull the red painted release handle located aft and left of pilot's seat. A nameplate labeled "Fire-Pull" identifies the location of the release handle. A 2 inch (5 cm.) pull is required to release the flow of CO_2 gas.

A "Lux" carbon tetrachloride type fire extinguisher, one quart (1.057 liters) capacity is located on a bracket attached to the left side of the rear cockpit.

Radio

Installation of "Learadio" controls is located on right side of cockpit, convenient to pilot's right hand. Two-way communication, voice or code; and interphone between cockpits is accomplished by use of the radio equipment.

Master Battery Switch

The master battery switch control is connected to a handle located to the left and aft of the pilot's seat.

When the handle is pulled up to the top position the switch is "OFF". When the handle is pushed down the switch is "ON", connecting the battery to the electric system of the airplane.

IMPORTANT: In the event of an emergency landing, pull the switch handle up to "OFF".

Spare Fuses

A set of spare fuses is clipped to the inside of the fuse box cover. This box is located in the left forward part of the cockpit below the electric switch panel.

9. LOCATION OF COCKPIT CONTROLS

Locations of the various controls are shown in photographs on pages 61 to 64 inclusive and include the following:

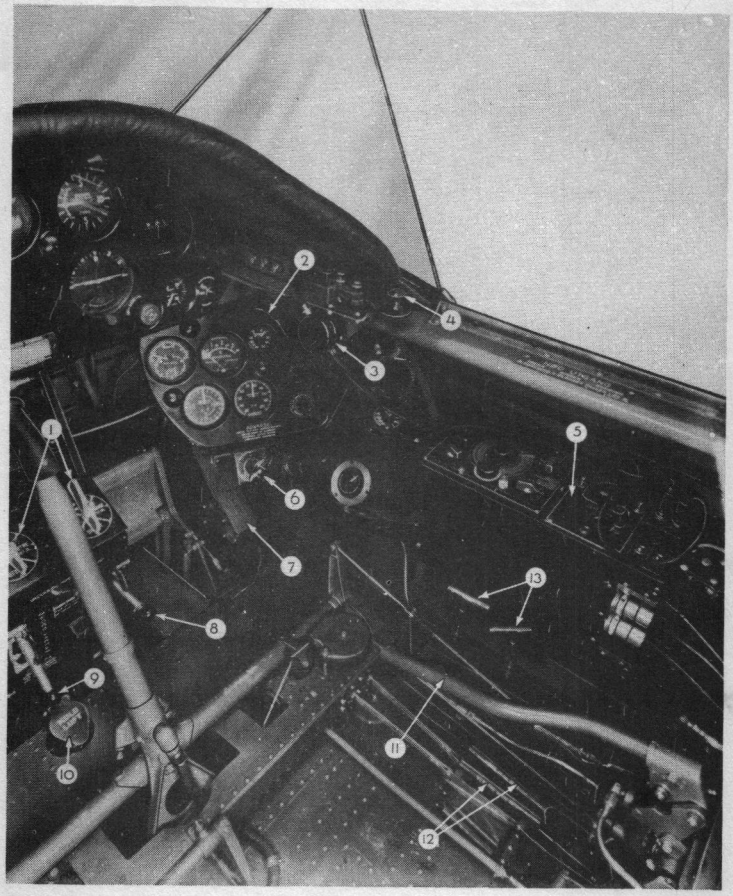
Flight Controls

Power Plant Controls

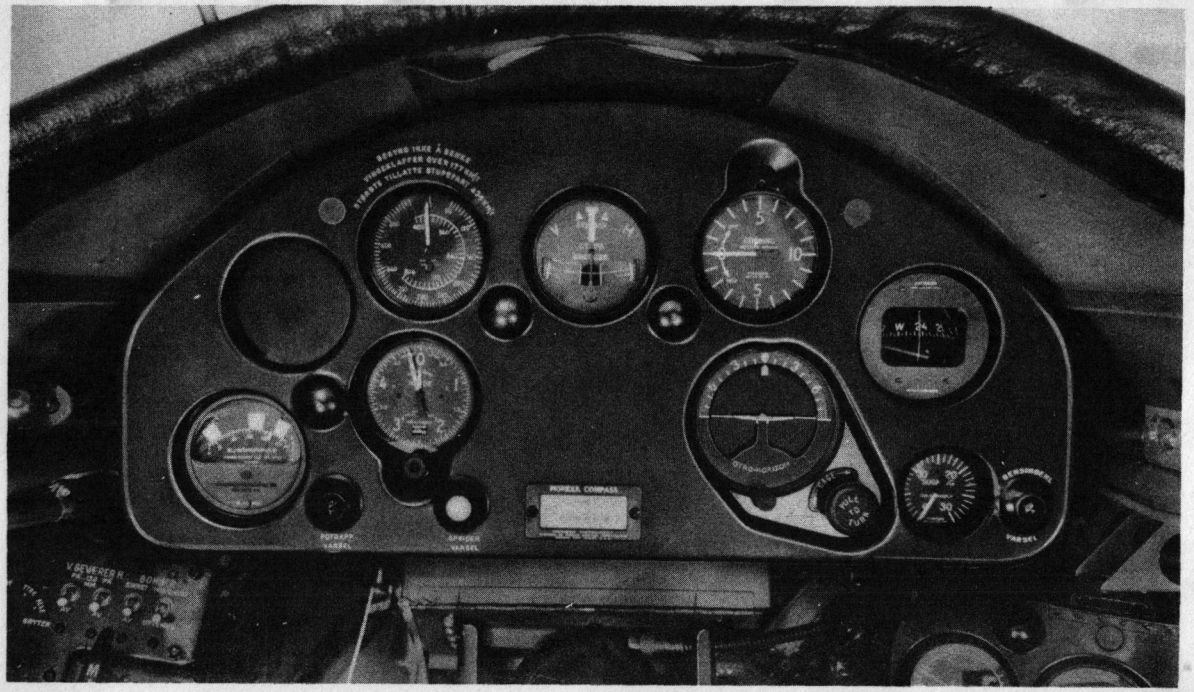
Instruments

8363 - Front Cockpit - Right Front

1. Fuel Tank Selector Valves
2. Engine Instrument Panel
3. Radio Headphones
4. Radio Code Key
5. Radio Installation
6. Engine Primer
7. Starter Pedal
8. Carburetor Air Intake Control
9. Cockpit Heat Control
10. Cockpit Cold Air Inlet
11. Hydraulic Pump Handle
12. .50 Caliber Gun Charging Handles
13. Flare Release Handles



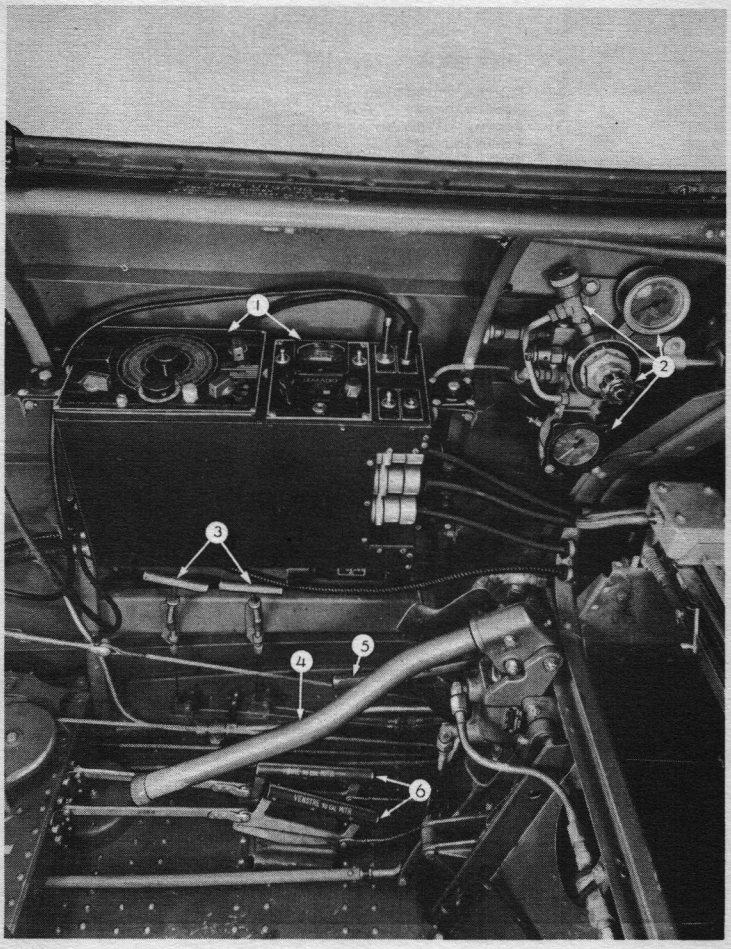
8363 - Front Cockpit - Right Front



8367 - Flight Instrument Panel

8408 - Front Cockpit - Right Rear

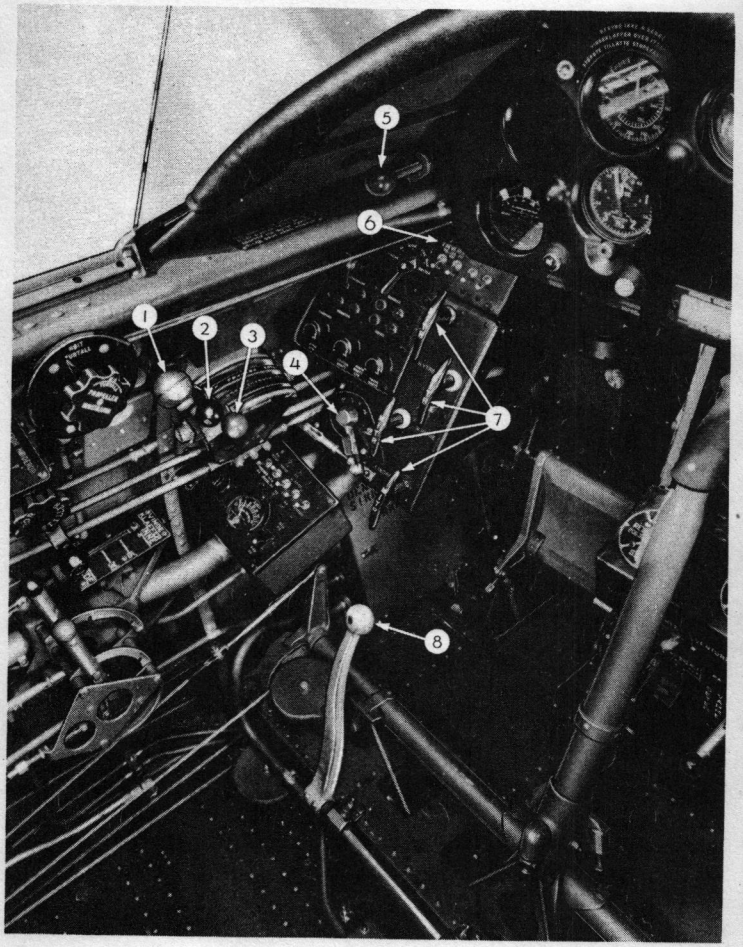
1. Radio Installation
2. Oxygen Installation
3. Flare Release Handles
4. Hydraulic Pump Handle
5. Landing Gear Selector Valve Lever
6. .50 Caliber Gun Charging Handles



8408 - Front Cockpit - Right Rear

8362 - Front Cockpit - Left Front

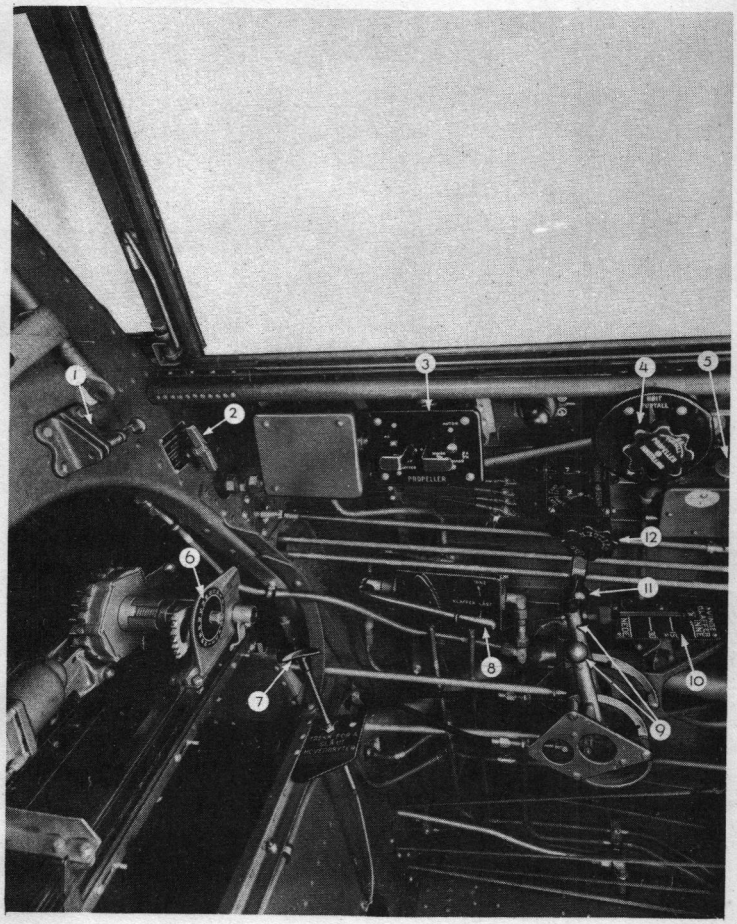
1. Engine Throttle
2. Supercharger Control
3. Engine Mixture Control
4. Ignition Switch
5. Hydraulic Thrust Knob
6. Electrical Control Panel
7. .30 Caliber Gun Charging Handles
8. Wobble Pump



8362 - Front Cockpit - Left Front

8410 - Front Cockpit - Left Rear

1. Control Locks Stowage Bracket
2. Engine Section Fire Extinguisher Handle
3. Electric Propeller Panel
4. Propeller Governor Control
5. Warning Horn Switch
6. Internal Bombs Counter
7. Master Battery Switch
8. Landing Flaps Selector Valve Lever
9. External Bombs Selector Lever
10. Landing Flaps Position Indicator
11. Elevator Tabs Crank
12. Rudder Tab Control Knob

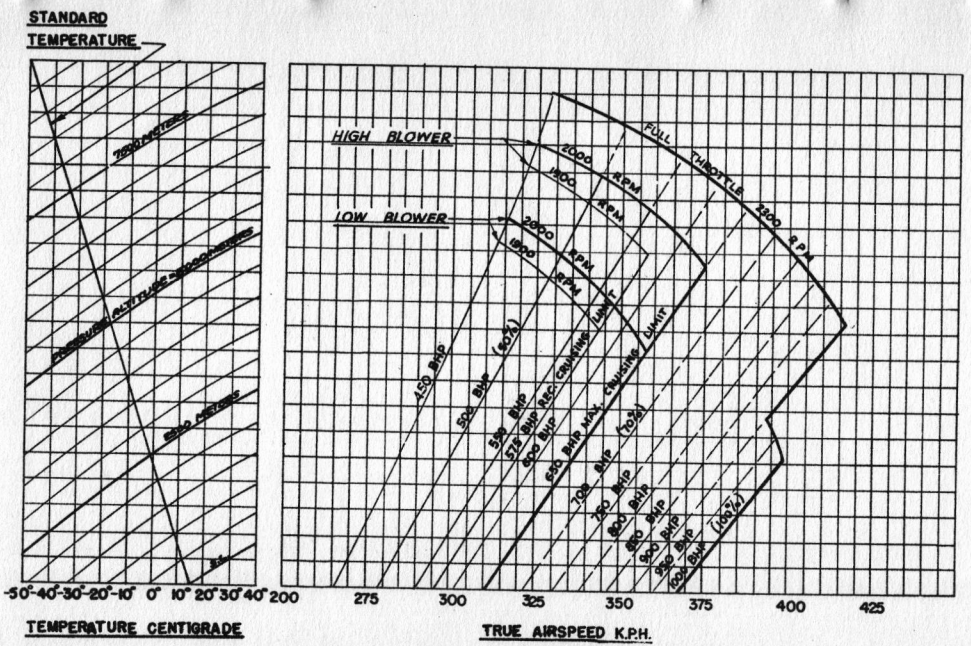


8410 - Front Cockpit - Left Rear

CONTINUOUS OPERATION

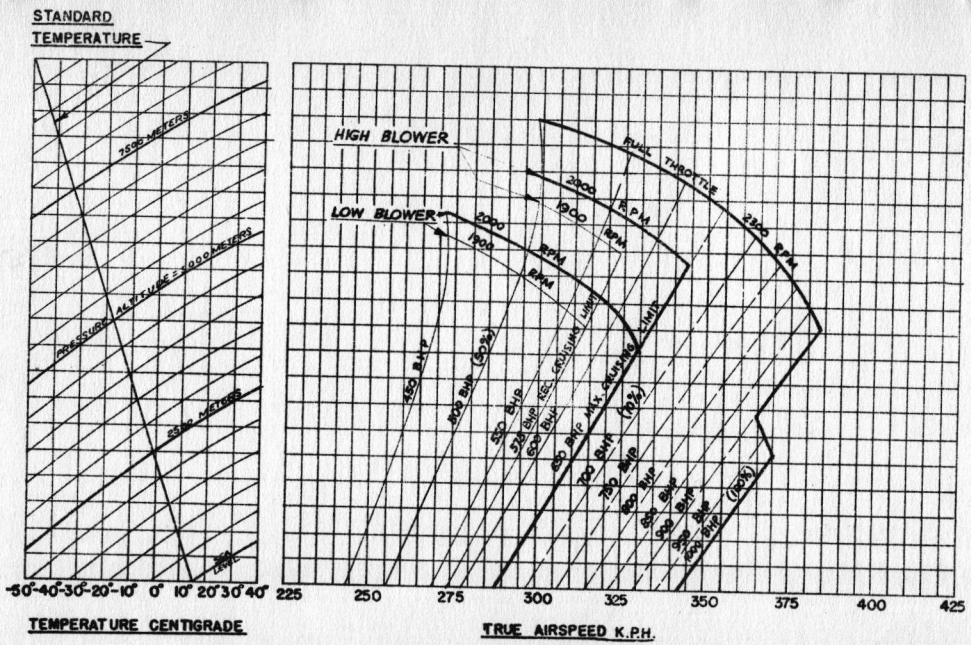
% Power	Altitude Blower Low - High	Limiting Manifold Pressure Low - High	RPM Blower Low - High	FUEL (Liters per Hr.)	OIL (Liters per Hr.)	TRUE AIRSPEED (K.P.H.)	RANGE (Kilometers)
60	Sea Level 1,524 m. 3,048 m. 3,048 m. 4,572 m. *4,390 m. *5,885 m.	72.8 cm. 69.4 cm. 77.9 cm. 65.8 cm. 74.6 cm. 63.0 cm. 71.8 cm.	1900 - 1900				
70	Sea Level 1,219 m. 3,048 m. 2,438 m. 4,572 m. *3,890 m. *5,520 m.	78.7 cm. 76.1 cm. 86.8 cm. 73.1 cm. 83.0 cm. 70.6 cm. 81.2 cm.	2050 - 2050				
80	Sea Level 1,219 m. 3,048 m. 2,438 m. 4,267 m. *3,320 m. *4,968 m.	85.3 cm. 82.5 cm. 95.9 cm. 79.8 cm. 93.2 cm. 78.2 cm. 91.6 cm.	2150 - 2150	(Full Rich)			
90	Sea Level 914 m. 3,048 m. 1,829 m. *2,780 m. *4,480 m.	92.2 cm. 90.0 cm. 105.7 cm. 87.9 cm. 85.9 cm. 102.4 cm.	2250 - 2250	(Full Rich)			
Full Power	Sea Level 914 m. *2,075 m.	99.3 cm. 97.0 cm. 94.8 cm.	2300	(Full Rich)			

* Critical Altitude For This Power and r.p.m.



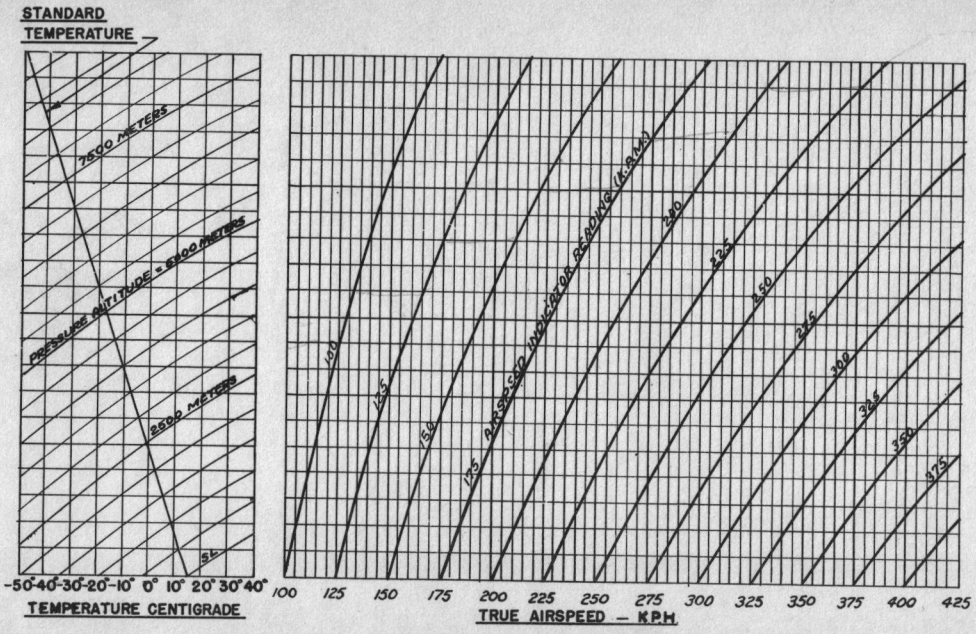
CRUISING SPEED CHART 8A-5

GROSS WEIGHT = 3535 KGS. ATTACK ENGINE : W. A. C. GR1820-G205A



CRUISING SPEED CHART 8A-5

GROSS WEIGHT = 3900 KGS. BOMBER ENGINE : W.A.C. GR1820 - G205A



AIRSPEED CORRECTION CHART 8A-5